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ABSTRACT

This paper presents the results of a study that tabulated statistics concerning Indiana science teachers who had participated in NSF-sponsored educational programs. The study yielded 25 major conclusions, including the following: science teachers who had attended NSF-sponsored teacher education programs prior to the spring of 1973 tended to be older, more experienced, had longer tenures in their major teaching assignment, and had taken more science, mathematics, and specific methods courses than their non-participating colleagues. (MH)

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# Impact of Participation in National Science Foundation Sponsored Teacher Education Programs on the Teaching of Science in Indiana Schools

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## Introduction

During the 1972-73 school year a study was undertaken (under the code name: Project FUTEPS) to assess the teacher education needs of teachers of science in Indiana classrooms. This study was conducted under the direction of a steering committee which included representatives from each of the five major state supported campuses and the Indiana Department of Public Instruction.

Questionnaires were distributed, through school principals to all Indiana public school teachers reported to the Department of Public Instruction as having a science teaching assignment. (Seven per cent of the elementary teachers were also surveyed but this sample is not treated in this report). 3,535 questionnaires were distributed using Indiana Department of Public Instruction mailing labels for reported science teachers, 2,545 (72.0%) forms were returned. The preparation of the questionnaire, the processing of the returned forms, and the initial treatment of the data and some initially outstanding results were discussed in "Project FUTEPS - A Status Survey of Science Teaching in Indiana," Proceedings of the Indiana Academy of Science for 1973 Vol. 83, 1974, pp. 424-428.

## Methods

In arriving at one statistic given in that report, it was necessary to combine the responses to five original items. To determine the number of teachers

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who indicated they had participated in any National Science Foundation (NSF) sponsored program, all positive responses to five items dealing with Summer Institutes, Academic Year Institutes, Inservice Institutes, Research Participation and other NSF sponsored programs were computer combined to create a new item for analysis. The computer was programed to eliminate any duplication caused by a teacher having taken part in more than one type of NSF program. By this treatment, the data revealed that, through the spring of 1973, only 45% of Indiana science teachers reported any participation in NSF sponsored teacher education programs.

Although several additional data treatments were anticipated during 1973 & 1974, none of these were undertaken after the Research Programer assigned to the FUTEPS file left the Ball State Computer Center. However, when it became apparent in March 1976 that the data contained in the file might provide important support to efforts to reactivate federal sponsorship of teacher education programs in science, the file was reactivated. On April 2, 1976, a cross tabulation was accomplished using the compressed NSF item described about to cross tabulate all original questionnaire items. The cross tabulation was preformed using the Statistical Package for the Social Sciences (SPSS) as in the initial study.

## Results

With little additional data treatment, the following observations can be made:

1. Although the median age of all science teachers responding in the spring of 1973 was 31.5, the median age of non-NSF participants was 28.2 while that of NSF participants was 36.3.

2. 68.8% of the NSF participants were assigned to schools which included in their structure grades 10 - 12 while only 50.9% of the non-NSF participants were assigned to these schools.

3. 60.5% of the non-NSF participants were assigned to schools which include the junior high grades while only 42.2% of the NSF participants were assigned to these schools.

4. 59.5% of the NSF participants had their major teaching assignment at the High School level while only 38.0% of the non-participants had such an assignment.

5. 28.9% of the NSF participants had their major assignment at the Middle School-Junior High level while 42.2% of the non-participants had such an assignment.

6. 330 (35.8%) of 922 science teachers with their major assignment at the middle school-junior high level had participated in NSF sponsored programs, 679 (56.0%) of 1213 science teachers with their major assignment at the high school had participated in these programs, and 95 (43.0%) of 221 teachers with combined Jr.-Sr. High assignments had participated.

7. 198 (19.3%) of 869 Bachelor's Degree teachers have participated in NSF sponsored programs, 633 (50.3%) of 1258 of those having a Masters or less than 30 semester hours beyond it, 316 (82.6%) of 385 with 30 or more semester hours beyond the Masters and 12 (75%) of 16 teachers holding a Doctors degree.

8. The median years of teaching experience of all science teachers is 7.3 years while it is 11.5 for NSF participans and 4.2 for non-participants.

9. The median number of years teaching their major subject assignment is 5.0 for all teachers, 8.4 for NSF participants and 2.8 for non-participants.

10. 34.7% of the General Science teachers, 50.3% of the Physical Science teachers, 48.5% of the Biology teachers, 55.4% of the Chemistry teachers, 49.6% of Earth Science teachers, and 69.1% of the Physics teachers have participated in NSF sponsored programs.

11. The median number of Biology courses taken by all science teachers was 6.6, it was 8+ for NSF participants and 5.4 for non-participants. 51.1% of the NSF participants have taken 9 or more Biology courses as compared with 9.3% for non-participants.

12. The median number of Chemistry courses is 2.4 for all science teachers, 3.6 for NSF participants and 1.7 for non-participants. 21.4% of the NSF participants have taken 9 or more Chemistry courses as compared with 9.3% for non-participants.

13. For earth science courses, the median data are 0.91 for all science teachers, 1.15 for NSF'ers and 0.76 for non-NSF'ers. For 9 or more courses: 9.8% for NSF'ers vs 6.0% for non NSF'ers.

14. For physics courses, the median data are 0.82 for all, 1.51 for NSF'ers and 0.46 for non-NSF'ers; 9 or more courses: 14.2% for NSF'ers vs 3.6% for non-NSF'ers.

15. For mathematics courses, medians are 1.7 for all, 2.4 for NSF'ers and 1.3 for non-NSF'ers; for 9 or more courses: 20.3% to 8.6% in favor of NSF'ers.

16. For science method courses at grade level of major assignment, the medians are 0.77 for all, 1.11 for NSF'ers and 0.57 for non-participants. Only 11.7% of the NSF'ers have not taken such a course while 22.9% of the non-NSF'ers have not. 53.3% of the NSF'ers have had more than one such course while only 29.5% of the non-NSF'ers have.

17. Only in biology, physics, mathematics and specific methods courses do the courses taken in the last ten years (prior to spring of 1973) indicate a significant advantage for the NSF'ers but then only slightly.

18. Of the 1141 science teachers who had participated in NSF sponsored programs, 79.2% of them reported they had attended one or more summer institutes, 22.8% reported attendance of one or more AYI's 39.1% reported participation in one or more Inservice institutes, 3.8% reported work in the Research Participation program, and 11.2% reported attendance to other NSF sponsored teacher education programs.

19. Only 244 (9.6% of the responders) reported attendance of other funded programs. 139 (56.0% of these had also participated in NSF programs while only 105 (43.0%) had not taken part in an NSF program.

20. Participation in NSF programs did not appear to significantly affect the number of teachers using elementary or junior high science programs developed with NSF sponsorship.

21. Participation in NSF programs did seem to be a significant factor in the use of high school science programs developed with NSF sponsorship. (This condition was particularly highlighted with regard to ECCP where only 2 of 14 who reported current or past usage of the materials indicated no NSF participation). Further data treatment is needed to determine the exact impact of NSF teacher education programs on usage of NSF sponsored curriculum materials.

22. Further analysis of the data is needed to determine if participation in NSF programs generally affected the teachers purposes and goals for science instruction. (A quick scanning of the data seems to indicate that non NSF'ers may have been more in tune with the purposes and goals commonly found in the 1972-73 science education literature than were the NSF'ers).

23. Although the SPSS treatment of the data on practices used by teachers fails to show and significantly valid differences between the NSF'ers had the non-NSF'ers, it appears that if the data was retabulated on the basis of only one of the possible six responses, consistent significance would emerge. From a quick scan of the cross tabulation, it seems that for all teaching practice surveyed, NSF participants responded much more frequently to the choice, "I use this practice with confidence" than did non-participants.

24. Although the SPSS data treatment does not generally indicate significant differences in the desire for most of the services surveyed, a purusal of this total block of data seems to indicate that generally NSF participants were less desirous of these services (particularly inservice programs) than non-participants.

25. Two services on which there was significant difference in terms desired assistance are:

    a. 25.6% of the NSF'ers vs 18.9% of the non-NSF's judged that it would be "exceptionally valuable" to have, "Programs aimed at improving the

school administrator's understanding of new science curriculum materials and techniques".

b. 53.1% of the non-participants vs 47.9% of the NSF'ers judged that it would be either "quite valuable" or "exceptionally valuable" to have, "Ready access to a persons knowledge in science education in the school district".

## Conclusions and Comments

From the above results it is clear that science teachers who had attended NSF sponsored teachers education programs prior to the spring of 1973 tended to be older, more experienced, had longer tenure in their major teaching assignment and had taken more science, mathematics and specific methods courses than their non-participating colleagues.

A higher percentage of high school science teachers have attended NSF sponsored teacher education programs than junior high science teachers. More Physics teachers have had attended NSF sponsored programs than any other discipline group, Chemistry teachers are the next most frequent attenders, about half of the Biology, Earth Science and Physical Science teachers have attended some NSF sponsored programs while only about one third of the General Science teachers have.

Only a few teachers have attended teacher education programs sponsored by funding sources other than NSF. These attendees tend to be about equally divided among NSF participants and non-participants, but when it is remembered that only 44.8% of the science teachers have participated in NSF programs, it appears that NSF attenders are also more frequent attenders of other programs.

Participation in NSF sponsored teacher education programs has had an influence in Indiana on the implementation of new science curriculum materials at the high school level but apparently not at the elementary and junior high level. This conclusion, however, should be viewed with caution since the participation of a

single elementary and junior high faculty member could have influenced implementation by an entire school--especially since NSF sponsored implementation activities for these programs more often tended to be leadership training programs.

Although the teachers' goals and purposes do not seem to have been afected by attending NSF teacher education programs, it should be remembered that the non-participants tend to be young teachers who would have more likely received most of their methods course recently. There is a strong possibility that many, if not most, of their methods instructors have themselves attended NSF programs.

Science teachers who have attended NSF sponsored teachers education programs tend to be more confident in using a variety of instructional practices and strategies. Of course there remains a question as to whether this confidence results from the NSF experiences or the fact that they are more experienced teachers.

Participants in NSF programs tend to be more desirous of administrative understanding of their programs than non participants. This condition probably can be attributed to the fact that the senior high teachers in this group are more frequently teaching new curriculum materials.

The fact that teachers who have not attended NSF sponsored teacher education programs are more desirous of Science Superivsor types in their school district could probably be attributed to one of two factors--either the lack of confidence in using a variety of instructional strategies or their lesser experience as teachers. Perhaps both factors have an influence here.

Finally the fact that science teachers who have attended NSF sponsored programs have taken more science, mathematics and specific methods courses than their fellow teachers might be attributed to their increased experience and age, but it unlikely that this contrast in age could account for the total difference in the number of courses taken.

## Summary

The data treated in this study includes only information on science teachers actually employed in Indiana public schools during the spring of 1973, it does not include former teachers whose NSF experiences have served as part of their qualifications for their present teacher education positions in colleges and universities. Undboutedly, many of the younger science teachers who had not, as yet, had opportunities to attend NSF sponsored programs received their pre-science methods from these instructors. When it was realized that this factor tends to reduce the difference between the two groups of teachers contrasted by this study, there remains very little reason to question the impact NSF sponsored teacher education programs have on science education in Indiana schools.